



Optical polarization analysis of supermassive black holes



SUMMARY.

Optical polarimetry of supermassive black holes provides an invaluable diagnostic for the geometry and physical mechanisms driving accretion flows, jets, and the acceleration of high-energy particles. Astrophysicists from the Skinakas observatory have pioneered the field with observations using RoboPol - a unique 4-channel polarimeter. This METEOR provides the unique opportunity to get hands-on experience in optical polarimetric observations and data analysis within the framework of the Black hOLE optical polarization TimE-domain Survey - BOOTES. BOOTES aims to understand particle acceleration in astrophysical jets through high-cadence observations of blazars and uncover the mechanism of accretion disk formation through observations of tidal disruption events.

— OBJECTIVES —

The student will learn the basics of polarimetry and optical polarimetric data analysis, basics of observing planning, and data acquisition.

— INSTITUTE —

The METEOR will take place at the Institute of Astrophysics and the Skinakas observatory located in the island of Crete in Greece.

- Institute of Astrophysics
- <https://www.ia.forth.gr/>
- N. Plastira 100, Vassilika Vouton, Heraklion, Crete, Greece
- Skinakas Observatory

— THEORY —

by YANNIS LIODAKIS

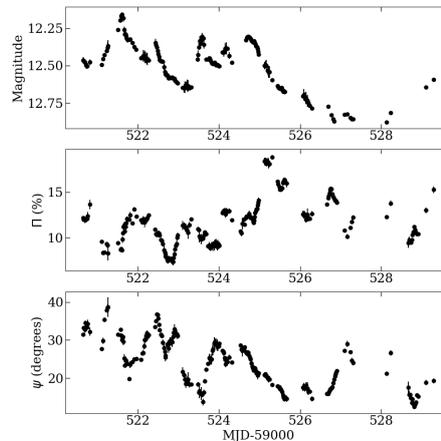
Supermassive black holes create beautiful structures like accretion disks and jets through magnetized plasma. Polarimetry allows us to trace the magnetic fields embedded in the plasma and trace their evolution with time. The student will be acquainted with the physics of accretion disks and jets, and how polarization observations can help us differentiate between competing models. They will also be acquainted to the basics of polarimetry and optical polarimetric data analysis.

— APPLICATIONS —

by YANNIS LIODAKIS

The student will be working on the data analysis of optical polarization observations of blazars and tidal disruption events from RoboPol at the 1.3m

telescope. They will be acquainted with the data calibration, analysis as well as the survey strategy, monitoring program, data acquisition, and telescope operations.



High-cadence optical polarization observations of blazar BL Lacertae. The observations we taken using 15 telescopes across the world (incl. Skinakas) to test particle acceleration in black hole jets. The top panel shows the evolution of optical brightness over time. The middle panel shows the evolution of the polarization degree, and the bottom panel the evolution of the polarization angle.

— MAIN PROGRESSION STEPS —

- **Tier 1:** Theory of polarimetry and black hole physics

- **Tier 2:** Optical polarization data analysis
- **Tier 3:** Interpretation of the results and comparison to theoretical models

— EVALUATION —

- **Theory grade [20%]**
 - Presentation of an article at the journal club (100%).
- **Practice grade [40%]**
 - Project (100%): initiative, understanding, overall data analysis performance
- **Defense grade [40%]**
 - Oral and slides quality
 - Context
 - Project / Personal work
 - Answers to questions

— BIBLIOGRAPHY & RESOURCES —

- Van Velzen et al., 2020
- Gezari 2021
- Blandford et al., 2019
- Hovatta & Lindfors 2019
- King et al., 2014
- Ramaprakash et al., 2019
- Blinov & Pavlidou 2019
- Liodakis et al., 2023
- Liodakis et al., 2024
- Stokes parameters
- RoboPol
- BOOTES

— CONTACT —

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